J. Terrell.

Circular Knitting Mach.

Patented Jan. 1, 1861.

No. 38.
31,042.

Fig. 1.

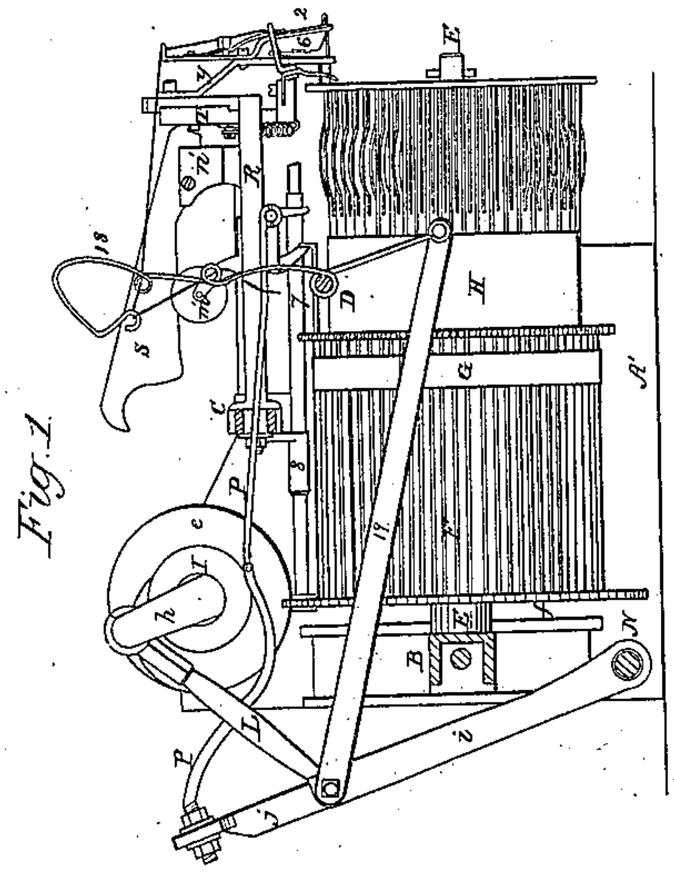

Fig. 2.

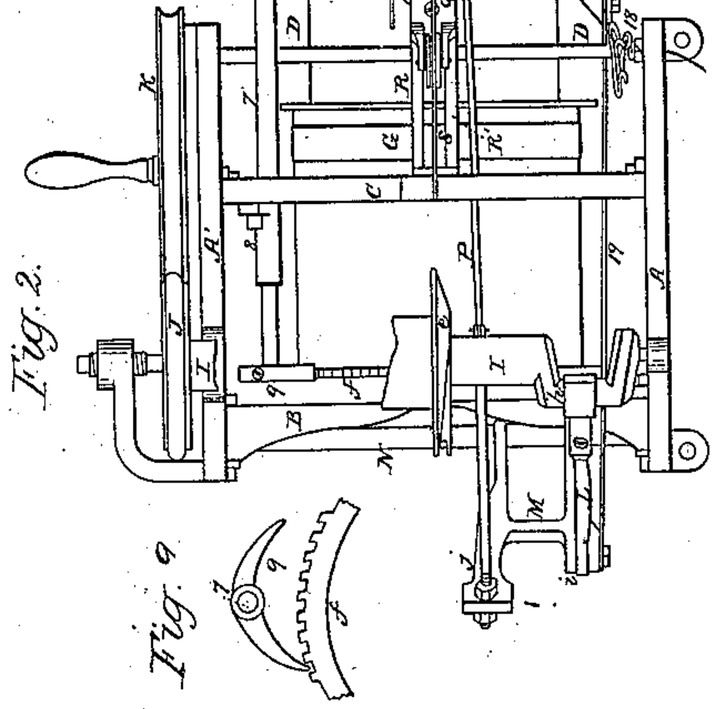

Fig. 3.

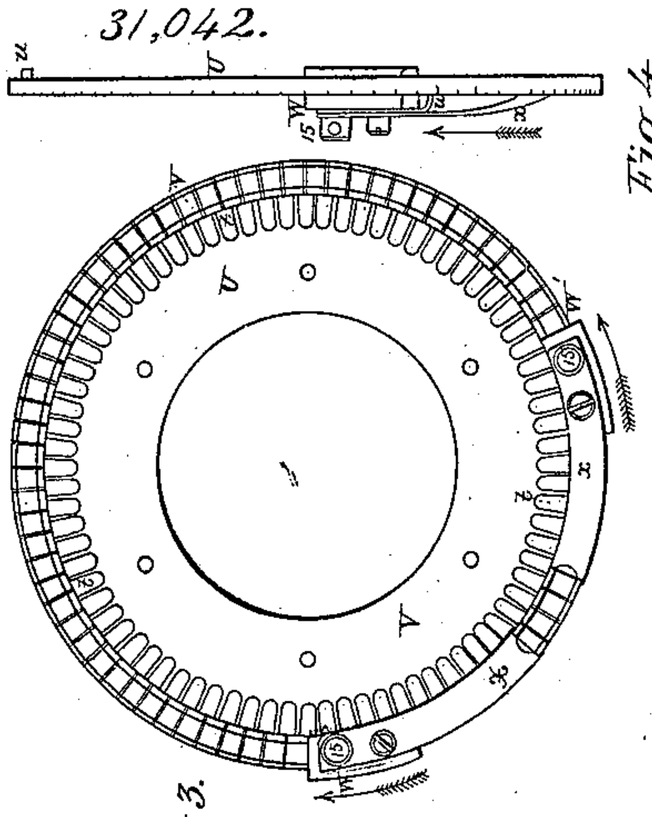

Fig. 4.

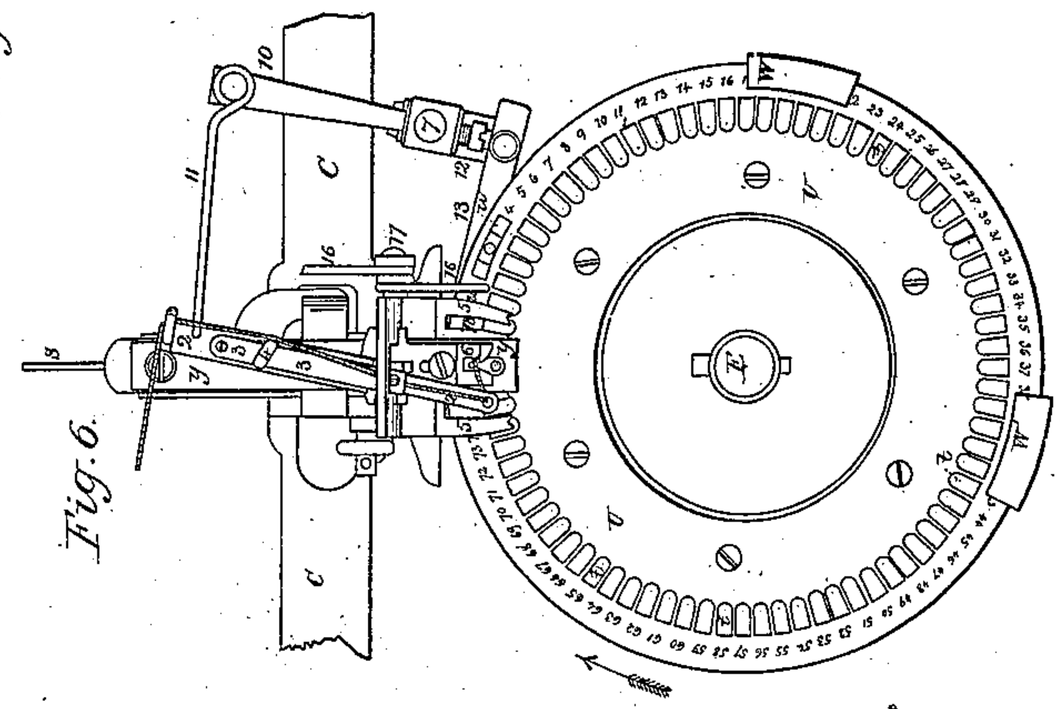

Fig. 5.

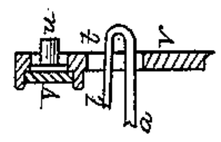

Fig. 6.

Fig. 7.

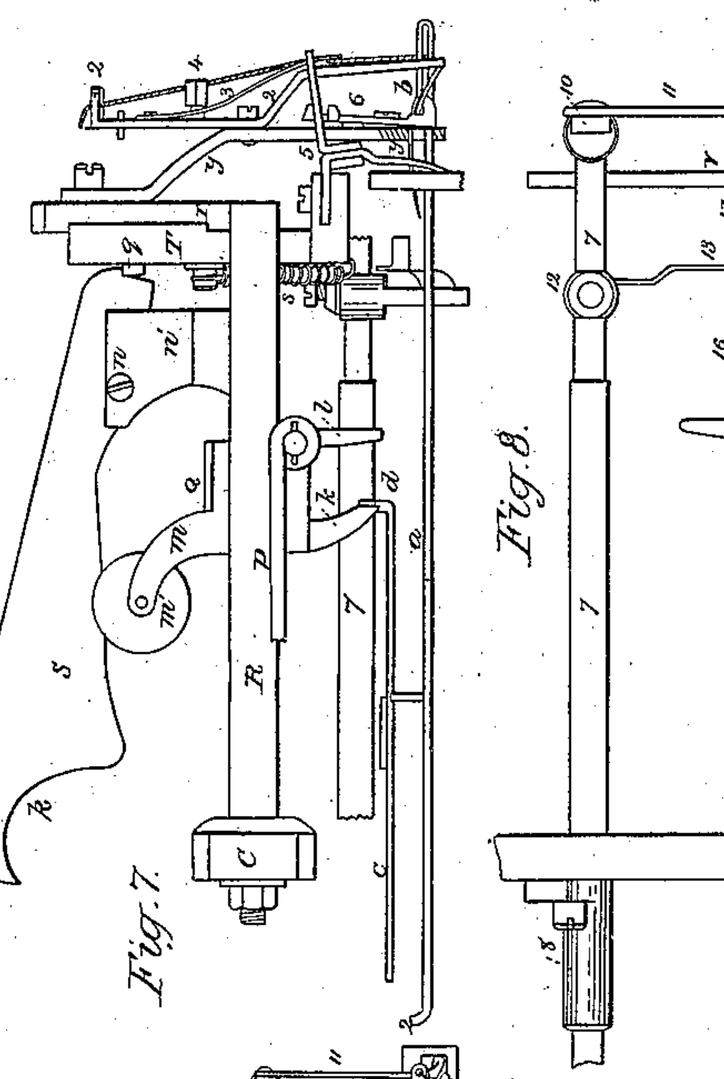

Fig. 8.

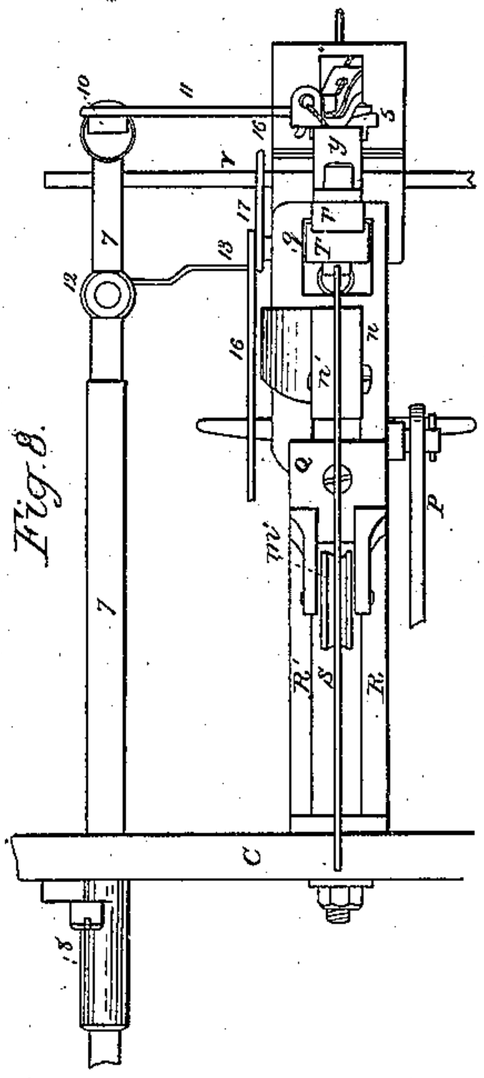

Fig. 9.

Witnesses
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UNITED STATES PATENT OFFICE.

JOHN TERRELL, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN KNITTING-MACHINES.

Specification forming part of Letters Patent No. **31,042**, dated January 1, 1861.

To all whom it may concern:

Be it known that I, JOHN TERRELL, of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Knitting-Machines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention relates to certain improvements in the knitting-machines for which Letters Patent were granted to Joseph Hollen on the 16th day of July, 1850, and on the 28th day of November, 1854; and my improvements consist of certain novel devices for operating the thread-presser, and also of peculiar mechanism, described hereinafter, for regulating the movements of the machine when employed for turning the heel and toe of the stocking.

In order to enable others skilled in the art to make and use my invention, I will now proceed to describe its construction and operation.

On reference to the accompanying drawings, which form a part of this specification, Figure 1 is a side view of a knitting-machine with one of the frames removed in order to illustrate my improvements; Fig. 2, a plan view of Fig. 1 with part of the machine broken away to show the works beneath. Fig. 3 is an inside view of the front plate; Fig. 4, an edge view of Fig. 3; Fig. 5, a cross-sectional view of part of Fig. 3; Fig. 6, a detached view of part of the front end of the machine; Fig. 7, a partial side view of the machine; Fig. 8, a plan view of Fig. 7, and Fig. 9 a detached portion of Figs. 1 and 2.

Figs. 1 and 2 are drawn to a scale of six inches to a foot, the remaining views representing portions of the full-sized machine.

Similar letters refer to similar parts throughout the several views.

A and A′ are the two side frames of the machine connected together by the rear cross-bar B, the upper cross-bar C, and the rod D. The rear cross-bar B carries a spindle or pin E, to which the needle-cylinder F is so attached that it can turn freely on the said pin; but can have no longitudinal or lateral motion thereon. This cylinder consists of a block of wood or metal having in its surface a series of longitudinal grooves for receiving the sliding needles, the latter being situated at an equal distance apart from each other and being so confined by straps or bands G and H to the cylinder that they (the said needles) can only move in a line parallel with the axis of the cylinder's rotation. This cylinder, with its needles, is constructed in a manner, for the most part, similar to that illustrated in the patent granted to J. Hollen, July 16, 1850.

The form of the needles will be best observed on reference to Fig. 7, where *a* represents the main stem of the needle adapted to one of the grooves of the cylinder; *b*, the usual spring-barb at the outer end of the needle; *c*, the upturned rear of the needle running parallel with the main body of the same, and *d* that projection of the needle by which the latter is moved backward and forward.

I, Figs. 1 and 2, is the main driving-shaft of the machine, turning in the opposite frames and driven by the handled friction-pulley K, which bears against the pulley J, or by any other suitable driving apparatus. This driving-shaft I is furnished with a worm *e*, gearing into the worm-wheel *f*, secured to the rear of the needle-cylinder F. The worm *e* is so constructed that one revolution of the driving-shaft I will turn the worm-wheel to the extent of one tooth, there being as many teeth as there are needles and as many needles as there are loops in the leg of the sock or stocking to be knitted.

The shaft I is cranked at *h*, and this cranked portion of the shaft is embraced by one end of the connecting-rod L, the opposite end of the latter being jointed to the arm *i* of the rocking frame M, which is secured to or forms a part of the shaft N, the latter vibrating in the opposite frames of the machine.

The upper end of the arm *j* of the rocking frame is connected by means of a jointed rod P to the slide Q, which is arranged to move in a horizontal direction only on and between the two guides R and R′, which are secured to the stationary cross-bar C of the frame. This slide Q has a projection *k* arranged to catch against the projecting portion *d* of each needle in succession and to push the same forward. The same slide is also furnished with a projection *l*, by which the needles are moved back at the proper time during the movement of the machine. The slide Q is also furnished with an upper projection *m*, carry-

ing a roller m', against the periphery of which bears the lower edge of the lever s, the altter being hung to a pin n on a bracket n', which is secured to or forms part of one of the guides R. The rear end of the lever S has a hollow or depression at k, for a purpose which will be rendered apparent hereinafter, and the front end of the same lever has a notch bearing on the top of a projection q on the vertical slide T, which moves on and is guided by a stationary vertical projection r or the end of the guides R and R', the slide T being depressed by the end of the lever S and raised by a spiral spring s during the movements of the machine, as more fully described hereinafter.

To the front end of the needle-cylinder is secured an annular plate V, Fig. 6, having orifices t equal in number to the needles, one needle being arranged to pass through each orifice, and the orifices being numbered as shown in the drawings. On the inside of this annular plate and near the periphery of the same is an annular recess for the reception of a ring V, (see Figs. 3, 4, and 5,) which at one point has a pin u projecting through a slot in the plate U. Two sliding blocks W and W' are so adapted and attached to the edge of the plate as to slide freely thereon, each block having two spring-dogs w and x, the former being arranged to engage into notches on the inside of the ring V and the latter into notches on the plate V.

To return to Figs. 7 and 8, y is a stationary hanger secured at the upper end to the vertical guide r on the guide-rods R and R', the lower end of this hanger having an orifice through which passes the barbed end of each needle in succession. This orifice performs an important duty, which will be more especially alluded to hereinafter. To the front of the hanger y is hung the thread-carrier 2, the upper end of which has an eye for receiving the thread, the latter passing downward, as seen in Fig. 7, through an eye in the end of the spring 3, between which and the bent portion of the thread-carrier the thread passes to the eye at the lower end of the said carrier. A set-screw 4, bearing against the spring and screwing into the carrier, serves to impart more or less tension to the thread. To the lower end of the slide T is secured the presser 5, which has a number of projections (seen in Fig. 6) situated close to the front of the plate v and arranged to depress the fabric already knitted away from the needles, the duty of this presser being similar to that performed by the presser in the aforesaid patent knitting-machine of J. Hollen. To the front of the stationary hanger y is connected the jumper 6, which is arranged to have a vertical reciprocating but no other movement, this motion being imparted partly by the barbed end of the needle and partly by the thread-presser 5, a portion of which is situated between projections on the upper end of the jumper, as seen in Fig. 6, the distance between these projections being such that the jumper has more or less vertical play independent of the presser. The lower end of the jumper has two projections, over one or other of which the thread passes toward the fabric.

On reference to Fig. 2 it will be observed that a shaft 7 is hung loosely to a bracket 8, attached to the cross-bar c of the frame-work. The rear end of this shaft 7 is furnished with a double catch 9, either point of which may be made to engage in the teeth of the wheel f by the operating of the shaft 7, which is also seen in Figs. 6 and 8, and the front end of which has an arm 10, connected by a rod 11 to the thread-carrier 2. The shaft 7 has another arm 12, to which is connected a bar 13, so situated and so formed that as the needle-cylinder revolves the projections 15 on the sliding blocks W and W' will come in contact with the bar, thereby operating the shaft 7 in the manner and for the purpose described hereinafter.

It should be understood that when the machine is used for knitting the leg of the stocking the rod 11 has to be disconnected from the thread-guide 2 and the arm 12, with its bar 13, moved back, so as to be free from contact with the projections 15 of the sliding blocks W and W'.

It has been already observed that a pin u, secured to the ring V, projects through a slot in the plate U, as seen in Fig. 5. This pin, which is also seen in Fig. 6, is arranged to come in contact with the end of the short arm of the lever 16, hung by a pin 17 to the slide T, which carries the thread-presser, the lever being so constructed and arranged as to yield laterally and allow the projection u to pass. By depressing the long arm of the lever 16 its short arm may be elevated to such a position as to be clear of the range of the pin u, which will be the case at all times, excepting when the heel and toe of the stocking are being knitted. The pin, coming in contact with the lever 16, will cause the ring V to be partially turned in its recess at the back of the plate U, thereby moving one or other of the sliding blocks W or W', for a purpose explained hereinafter.

To the cross-bar D is hung the lever 18, to which a vibrating motion is imparted by a rod 19, connected to the arm i of the rocking frame M. The upper arm of this lever has three or more eyes, (see Fig. 1,) through which the thread passes from an adjacent spool to the thread-carrier 2, Fig. 7. More or less friction is imparted to the thread by the same passing through the eyes in the lever 18, so that by the vibration of the latter the thread is taken up and let out at the proper time.

Operation of the machine.—It will be observed that as the cranked shaft I is turned a reciprocating motion will be imparted to the slide Q on the guide-bars R and R' through the vibration of the rocking frame M, and that the needle-cylinder F will be partially turned

by the worm *e* acting on the worm-wheel *f*, which is turned to the extent of one tooth during every complete revolution of the cranked shaft, the cylinder being consequently turned to an extent equal to the distance between the centers of two of its needles. During the outward movement of the slide Q its projection *k*, having caught hold of the projection *d* of one of the needles, moves the latter forward and projects its barbed end through one of the openings *t* in the plate U. On the return movement of the slide its projection *l* serves to restore the needle to its original position. The above movements of the needle and the manner of producing the same are similar to those described in the aforesaid patents of J. Hollen. When the needle is at the limit of its outward movement, the loop previously formed is situated at a distance from the point of the barb on the body of the needle, the thread, which passes from the carrier over one of the projections of the jumper, as seen in Fig. 7, taking its place within the barb. Now the bend of the barb and the dimensions of the eye in the end of the hanger *y*, through which the end of the needle must traverse, are such that as the needle begins to move back the point of the barb will be pressed into a recess or groove formed in the needle. On the further backward movement of the needle, therefore, its barb, together with the thread, will be drawn through the loop on the needle, the thread forming another loop, which will take its place on the body of the needle, the first loop being released from the end of the latter as it completes its backward movement and the first loop taking its place in the body of the fabric. When the needle is at the limit of its inward movement, the recessed portion *k* of the lever S rests on the roller *m'* of the slide Q, the slide T, with its thread-presser 5 and jumper 6, being consequently at their most elevated position. When the needle has moved a short distance forward, however, the roller *m'* suddenly raises the lever S, thereby imparting the necessary depression to the slide T and its presser-bar. The jumper 6, which has more or less vertical play independent of the presser, is now at liberty to be raised by the advancing needle, thereby raising the thread and preventing the latter from getting beneath the needle. As the needle returns, the roller *m'*, acting on the inclined portion of the lever S, raises the latter and lowers the presser, together with the jumper, which is thus placed in a proper position to guide the thread to the barb of the needle. It will be thus seen that the proper control of the thread to insure its proper position in respect to the needle and its barb is exercised by the jumper, the movements of which are controlled partly by its connection with the presser and partly by the needle itself.

In the aforesaid Hollen machine, patented November 28, 1854, the barb of the needle is depressed by complex appliances operated by the moving parts of the machine. These I dispense with by causing the needle to pass through a stationary eye, which, together with the form of the barb, renders the latter self-opening and self-closing. It will now be seen that as the driving-shaft revolves a continuous circle of loops is formed, thereby forming the leg of the stocking, the number of the loops in the present instance being eighty, as indicated on the graduated plate U.

Before commencing the knitting of the heel of the stocking the arm 10, Fig. 6, is connected to the thread-carriers 2 by the rod 11, and the lever 16 is moved so as to bring its short arm within the range of the pin *u*. The number of stitches required at the commencement of the turning of the heel having been determined upon, the sliding blocks W and W' are moved to such a position on the plate U that between the block W' and the block W (counting in the direction of the arrow) the number of orifices *t t* in the said plate shall be equal to the number of stitches required. The needle-cylinder being caused to revolve in the direction of the arrow, Fig. 6, the operation of knitting will be continued until the sliding block W' strikes against the bar 13 on the arm 12, thereby turning the shaft 7 and moving the dog 9, so that one of its points will engage into the teeth of the worm-wheel *f*, thus stopping the further movement of the machine. This stoppage is an indication that the first row of loops for the heel is completed, and is a signal for the operator to turn the machine in the reverse direction. This reverse movement is continued until the sliding block W catches the bar 13, and thereby moves the dog 9 until that point of the latter previously out of gear with the wheel *f* engages into the teeth of the said wheel, when the machine is again stopped. Before the sliding block W, however, has reached the rod 13, the projection *u* on the ring V has struck the short arm of the lever 16, thereby moving the ring to the extent of one loop and pulling the block W' in the direction of the arrow, Fig. 3, to the extent of one step in the graduated plate U. The lever 16, after thus temporarily obstructing the pin *u*, yields and allows the latter to pass until the block W catches the bar 13 and stops the machine, as before described. It will be observed that this movement of the ring in the direction of the arrow, and consequent movement of the block W', did not disturb the position of the block W, whose spring *x* retained its hold of the teeth at the back of the plate U. To return to the movement of the machine, which is again turned in the direction of the arrow, Fig. 6, the projection *u* will again come in contact with the yielding lever 16, thereby turning the block W in a direction contrary to that pointed out by the arrow and to the extent of one loop, the block W' remaining undisturbed. Thus at every reversal of the machine, first the block

W and then the block W′ is moved, one toward the other in the direction shown by the arrow, Fig. 3, the movement being to the extent of one step on the graduated plate, or, in other words, to the extent of one loop, so that the movement of the cylinder F when each successive signal is given for reversing is diminished to the extent of one loop, and consequently every row of loops added to the fabric becomes one less in number than that preceding it, thus giving the desired turn to the heel. At the instant the movement of the shaft 7 is effected by one of the sliding blocks catching the rod 13 the thread-carrier is moved by the lever 10 and rod 11. Thus the moment the block W catches the rod 13 the thread-carrier is vibrated to the position shown in Fig. 6, and the moment the block W′ strikes the same rod 13 the lever is moved to the contrary angle. By this arrangement the position of the thread is so changed at every reversal of the machine that it assumes the proper angle in respect to the needle and its barb. After the heel has been turned the rod 11 is detached from the thread-carrier 2 and the arm 12 is slid back on the shaft, so that its bar 13 shall be free from the range of the sliding blocks when a continuous rotary motion is imparted to the needle-cylinder, as during the operation of its needles on the leg of the stocking until the greater portion of the foot is knitted. When the toe of the stocking is about being turned, the machine is again altered, so that its several parts assume the same relative position as that which they occupied when the heel was being turned, a gradual taper being thus imparted to the toe, the end of which has to be closed by hand-stitching.

Disclaiming all the devices described and claimed in the aforesaid patents of Joseph Hollen, I claim as my invention and desire to secure by Letters Patent—

1. Operating the thread-presser 5 by means of the reciprocating slide Q and its roller *m′*, in combination with the lever S, vertical slide T, and spring *s*, the whole being constructed and arranged substantially as herein set forth.

2. Giving the signal for reversing the motion of the machine on turning the heel or toe of the stocking by means of the sliding blocks W and W′ on the edge of the plate U, in combination with the shaft 7, its arm 12, bar 13, catch 9, and ratchet-wheel *f*, the whole being arranged and operating substantially as set forth.

3. The plate U, ring V, its projection *u*, the blocks W and W′, with the springs *x* and *w*, engaging into the notches on the back of the said plate U and said ring V, as specified, in combination with the movable yielding lever 16, the whole being arranged for joint operation substantially as and for the purpose specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN TERRELL.

Witnesses:
HENRY HOWSON,
CHARLES E. FOSTER.